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AUTHOR Barron, Marcia L.; Obringer, S. John
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ABSTRACT

This study compared the cognitive abilities of children with myelomeningocele born between 1975 and 1981 (and recipients of aggressive, sophisticated medical treatment) with those of children born two decades earlier. Verbal, performance, and full scale IQ scores on the Wechsler Intelligence Scale for Children (Revised) were collected on 20 children. The level of lesion for each subject was also identified from medical records. Analysis of findings indicated that the intellectual integrity of children receiving more aggressive medical treatment was not significantly different from that of children born earlier. Subjects achieved a mean verbal IQ of 82, a mean performance IQ of 74, and a mean full scale IQ of 76. Compared to the standardization sample, subjects scored within 1 to 2 standard deviations below the mean. Unlike earlier studies, the level of lesion did not appear to correlate significantly with intellectual functioning. Also, this population demonstrated great variance in functioning levels, suggesting the necessity of individualized profiles of strengths and deficits for appropriate educational programming. (Contains 17 references.) (DB)

The Intellectual Functioning of Children with Myelomeningocele

By

Marcia L. Barron

Mississippi Children's Rehabilitation Center

S. John Obringer

Mississippi State University

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INTRODUCTION

The decade of the 1960s saw the first significant number of myelomeningocele children survive infancy. This new population of handicapped children brought new demands and challenges to parents, health care professionals, and educators. Because of a myriad of neurological, urological, and orthopedic problems, children with myelomeningocele were often unserved or underserved by their local education agency until the passage and implementation of Public Law 94-142. In accordance with the mandates and interpretations of P.L. 94-142, all children with myelomeningocele are now guaranteed a free, appropriate, public education in their least restrictive environment and are provided necessary related services in order to derive maximum benefit from individualized educational programming. Today, educators are challenged to provide quality educational services to a group of children who display a unique intellectual profile and learning style.

In an effort to identify this intellectual profile and learning style of children with myelomeningocele, a number of researchers have examined the cognitive functioning of this population. However, the major research focus has been on intra-group variables, i.e., the level of lesion (Sand, Taylor, Rawlings

& Chitris, 1973; Shaffer, Friedrich, Shurtleff & Wolf, 1985), the presence of hydrocephalus (Soare & Raimondi, 1972; Tew & Lawrence, 1975), and central nervous system complications (Hunt & Holmes, 1975; McLore, Czyzeuski, Raimondi & Sommers, 1982), as they relate to intellectual functioning. Intra-group research has revealed a significant difference between Verbal and Performance IQs of children with myelomeningocele where the Verbal IQ exceeded the Performance IQ on the Wechsler Intelligence Scale for Children (WISC) (Shaffer et al., 1985; Tew, 1977).

When inter-group intellectual functioning was examined, significant differences in intellectual functioning were found between children with myelomeningocele and the standardization sample for the WISC. Shaffer et al. (1985) found significant differences on the WISC Performance IQ and Full Scale IQ scales with this population scoring below the standardization population of both scales of the WISC. No significant difference was found for the WISC Verbal IQ scores. In addition, significant differences were found on all except three of the WISC subtests (Similarities, Vocabulary, and Picture Completion).

A study by Tew (1977) found significant differences on the WISC Verbal, Performance, and Full Scale IQs of children with myelomeningocele when compared with the standardization population. All three IQs were significantly lower than the standardization norms on the WISC.

However, Tew, Evans, Thomas, and Ford (1985) found no significant difference on Verbal, Performance, and Full Scale IQs for the sample's "selected in" group, i.e., the group of children selected for immediate surgery after birth. However, significantly lower scores were found for both the "selected out" and "unselected" group, which included children excluded from immediate treatment because of the presence of one or more "poor outcome" criteria. However, this research may not be applicable to children in this country since most children with myelomeningocele in the United States are treated aggressively from birth.

Much of the currently available research on the cognitive functioning of children with myelomeningocele was based on subjects born in the 1960s and early 1970s. These children did not benefit from the use of noninvasive diagnostic techniques, such as computerized axial tomograms (CT scans) and magnetic resonance imaging (MRI) to detect and monitor hydrocephalus, which occurs in 80-90% of the population (Bleck & Nagel, 1982; Umbriet, 1983). Careful monitoring of hydrocephalus is crucial to the maintenance of intellectual integrity, as this anomaly is reported to be the single most important cause of intellectual loss (Tew, 1977).

The present study resulted from an assumption by the author that the cognitive abilities of children with myelomeningocele

born in the last decade may differ significantly from those children born two decades ago and who comprise the sample upon which much of the available research was based. Therefore, an examination of the effect of aggressive, sophisticated medical treatment on the cognitive functioning of children with myelomeningocele was warranted.

Statement of the Problem

The major problem in this study was to investigate the intellectual functioning of children born with myelomeningocele between 1975-1980, inclusive. The Wechsler Intelligence Scale for Children-Revised (WISC-R) was utilized to measure intellectual functioning.

To solve this problem, answers to the following questions were sought.

1. How do the Verbal, Performance, and Full Scale IQ scores on the WISC-R compare to the scores of the WISC-R standardization population?
2. How do the 10 WISC-R subtest scores of children with myelomeningocele compare to the subtest scores of the standardization population?
3. Does the lesion level of children with myelomeningocele predict intellectual functioning?

This researcher predicted that the intellectual functioning of

children born with myelomeningocele in the last decade would not differ significantly from the standardization population of the WISC-R. The research hypotheses are offered in the null form using the .05 level of significance for testing the hypotheses. These hypotheses are as follows:

1. There will be no significant difference between the Verbal, Performance, and Full Scale IQ scores for children with myelomeningocele and the standardization population for the WISC-R.
2. There will be no significant difference between scaled scores on the WISC-R subtests of children with myelomeningocele when compared to the standardization population.
3. The level of lesion for children with myelomeningocele will not predict intellectual functioning.

Assumptions

The following assumptions were made for this study.

1. Children in this sample were representative of the population of children with myelomeningocele with regard to socio-economic background, lesion level, shunt presence, and central nervous system complications.
2. Children in this sample have received comprehensive, aggressive medical and therapeutic services since birth.
3. Children in this sample display the same incidence of

hydrocephalus as reported in the literature (80-90%).

4. WISC-R test results were reliable and valid for this sample.

Limitations

1. Because of problems associated with severe neurological dysfunctions, subjects in this sample did not always display uncomplicated cases of myelomeningocele. For example, one child had had a stroke as an infant, one was diagnosed as cerebral palsied, etc.
2. Children in this sample were identified through a statewide children's medical program which requires a financial eligibility in order to receive services. Therefore, this sample may not represent all socio-economic strata.

Definition of Terms

1. Lesion level--point below which no nerve sensation is present:
   a. High lesion--above Thoracic 10
   b. Mid lesion--Lumbar 1-3 and Thoracic 10
   c. Low lesion--Lumbar 4-5 and all Sacral
2. Myelomeningocele--extension of spinal cord through an opening at the back of the vertebral column where bone failed to form.

METHODS

Subjects

The subjects in this study were 20 children with

myelomeningocele born between the years 1975 and 1981, inclusive. These children were not controlled for hydrocephalus or central nervous system complications, but represent a random sample of the myelomeningocele population in this particular age group.

The subjects in this study were identified through a statewide children's medical and rehabilitation program, as well as an aquatic program for physically handicapped children.

Data Collected

Verbal, Performance, and Full Scale IQ scores along with Scaled Scores from each subtest of the WISC-R were collected. The level of lesion for each subject was also identified from medical records and grouped according to low, mid, or high.

Procedure

The Wechsler Intelligence Test for Children-Revised (WISC-R) was administered to each subject by a certified psychometrist according to test standardization procedures. No deviations from acceptable practices occurred in either student test behavior or testing conditions. Optional subtests were not administered.

Both the mean and mode were used as measures of central tendency to define the intellectual profile of children with myelomeningocele. A one tail t-test for independent samples, a Pearson correlation, and analysis of variance were utilized to determine if this population of children with myelomeningocele

differed significantly from the standardization population of the WISC-R. The significance of lesion level was also examined.

RESULTS

This research study demonstrated that the intellectual functioning of children with myelomeningocele differed significantly from the WISC-R standardization population. The WISC-R has a mean score of 100 with a standard deviation of 15 for all IQ scores. The population under investigation achieved a mean Verbal IQ of 82.25 with a standard deviation of 16.55, a mean Performance IQ of 74.45 with a standard deviation of 18.07, and a mean Full Scale IQ of 76.40 with a 17.87 standard deviation. See Table 1.

Table 1

Mean Scores for Verbal, Performance, and Full Scale IQs.

Variable	Mean	Standard Deviation	Range
VIQ	82.25	16.55	50-107
PIQ	74.45	18.07	45-101
FSIQ	76.40	17.87	43-101

Table 2 represents the mode for the population under investigation. Only 50% of this sample achieved Verbal IQ scores

±1 standard deviation. Sixty-eight percent of the standardization population achieved scores within ±1 standard deviation. Only 30% of the population under investigation achieved scores within the ±1 standard deviation on the Performance IQ scale, with 35% achieving such scores on the Full Scale IQ scale.

Table 2

Modal Scores for Verbal, Performance, and Full Scale IQs.

Variable	-4SD		-3SD		-2SD		-1SD		+1SD	
	N	%	N	%	N	%	N	%	N	%
VIQ	1	5	5	25	4	20	8	40	2	10
PIQ	4	20	2	10	8	40	5	25	1	5
FSIQ	4	20	2	10	7	35	6	30	1	5

A significant statistical difference exists when comparing intra-group Verbal and Performance IQ scores, with the Verbal IQ scores being significantly greater than both the Performance and Full Scale IQ scores (< .05 level). See Table 3.

Table 3

T-test for Independent Samples Comparing Verbal, Performance, and Full Scale IQs.

Variable	$\bar{X}$	SD	T-value	Confidence Level
VIQ	82.25	16.55	3.23	< .05*
PIQ	74.45	18.07		
VIQ	82.25	16.55	4.59	< .05*
FSIQ	76.40	17.87		
PIQ	74.45	18.07	-1.59	> .05
FSIQ	76.40	17.87		

*Significant at .05 level.

Analysis of WISC-R subtests revealed that Information, Similarities, Vocabulary and Picture Completion scores all fell within the normal range for Scales Score values (7-10). Coding, a visual motor copying task, yielded the lowest Scaled Score. Mean Scaled Scores for Arithmetic, Comprehension, Picture Arrangement, Block Design, Object Arrangement, and Coding were greater than -1 standard deviation (Table 4).

Table 4

Mean Scores for WISC-R Subtests.

Variable	Mean	Standard Deviation	Range
I	7.45	3.27	1-13
S	7.85	3.19	1-12
A	6.70	3.03	1-11
V	7.5	3.39	1-15
C	6.25	2.75	1-11
PC	7.35	3.48	1-13
PA	6.25	3.40	1-12
BD	5.95	3.76	1-13
OA	6.60	3.59	1-14
CD	4.90	2.36	1-11

Table 5 illustrates data when the mode is utilized as a measure of central tendency. Forty percent of the sample scored below the average range of scaled scores (7-10) on the Information subtest, 25% on Similarities, 40% on Arithmetic, 50% on Comprehension, 35% on Picture Completion, 50% on Picture Arrangement, 40% on Block Design, 30% on Object Arrangement, and 95% on Coding.

Table 5

Modal Scores for WISC-R Subtests.

Variable	Scaled Scores									
	1 - 3		4 - 5		7 - 10		11 - 13		> 14	
	N	%	N	%	N	%	N	%	N	%
I	1	5	7	35	8	40	4	20	0	0
S	2	10	3	15	11	55	4	20	0	0
A	3	15	5	25	10	50	2	10	0	0
V	2	10	7	35	8	40	2	10	0	0
C	2	10	8	40	9	45	1	5	1	5
PC	2	10	5	25	8	40	5	25	0	0
PA	5	25	5	25	7	35	3	15	0	0
BD	7	35	1	5	10	50	2	10	0	0
OA	5	25	1	5	12	60	1	5	0	0
CD	8	40	9	45	2	10	1	5	0	0

In this investigation, the level of lesion did not significantly correlate with intellectual functioning.

DISCUSSION

Results of this study indicated that children with myelomeningocele displayed significantly depressed intellectual functioning in Verbal, Performance, and Full Scale IQs. Also, a

significant discrepancy between Verbal and Performance IQs was found. This research data supports earlier findings of Shaffer et al. (1985) and Tew (1977). Mean IQ scores indicated this sample fell within the the -1 to -2SD of the mean ($\bar{x}$ = 100; S.D. = 15). However, a large range of scores occurred on all IQ measures, thereby attesting to unique individual intellectual profiles. Contrary to earlier studies, these research results did not demonstrate a significant correlation when comparing lesion level and intellectual functioning (Sand, Taylor, Rawlings & Chitris, 1973; Shaffer, Friedrich, Shurtleff & Wolf, 1985).

These research findings have great educational implications when developing curricular programming for children with myelomeningocele. First, this population demonstrated great variance in functioning levels. In order for the student to be appropriately served, an individual profile of strengths and deficits must be developed. Secondly, this research, as well as other previous research, indicated this population will have greatest success with tasks involving verbal skills. When the transition is made from verbal to written materials and when tasks require visual-motor integration competencies and speed, the child with myelomeningocele may begin to experience academic difficulty. Therefore, these children will need support services to successfully complete academic competency requirements. These necessary services could include, but are not limited to, an aide,

a resource teacher, assistive devices such as a cassette recorder, typewriter, computer assisted instruction, modified written assignments, etc. With comprehensive evaluations and individual programming, children born with myelomeningocele may well be able to achieve academic success.

The results of this research may have medical implications as well. In spite of sophisticated and aggressive medical treatment, the intellectual integrity of children with myelomeningocele does not appear to be significantly different from those children born a decade earlier. Perhaps centers of cognition were compromised along with a malformation of the spinal cord. Further studies to document this intitial finding are warranted.

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Signature: S. J. Obringer

Printed Name/Position/Title: Stephen John Obringer

Organization/Address: Miss. State University
Box 9705
Miss. State, MS 39762

Telephone: (601) 325-3747

FAX: (601) 325-7851

E-Mail Address: sjol@ra.msstate.edu

Date: Dec. 19, 97

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